

# (12) UK Patent Application (19) GB (11) 2 072 516 A

(21) Application No 8010808

(22) Date of filing  
31 Mar 1980

(43) Application published  
7 Oct 1981

(51) INT CL<sup>3</sup> A62B 18/02

(52) Domestic classification  
A5T CB

(56) Documents cited

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GB 559064

(58) Field of search

A5T

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(54) Improvements in and relating  
to respiratory face masks

(57) This invention relates to a respiratory face mask in the form of a pouch (1,2) shaped to cover the nose and mouth of the wearer, the pouch being formed from filtration-effective sheet material and being provided with one or more exhalation valves (12).

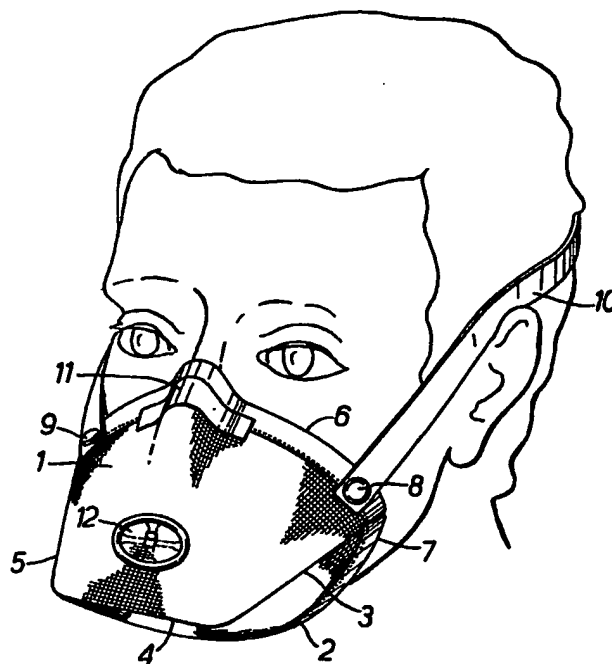


Fig. 1.

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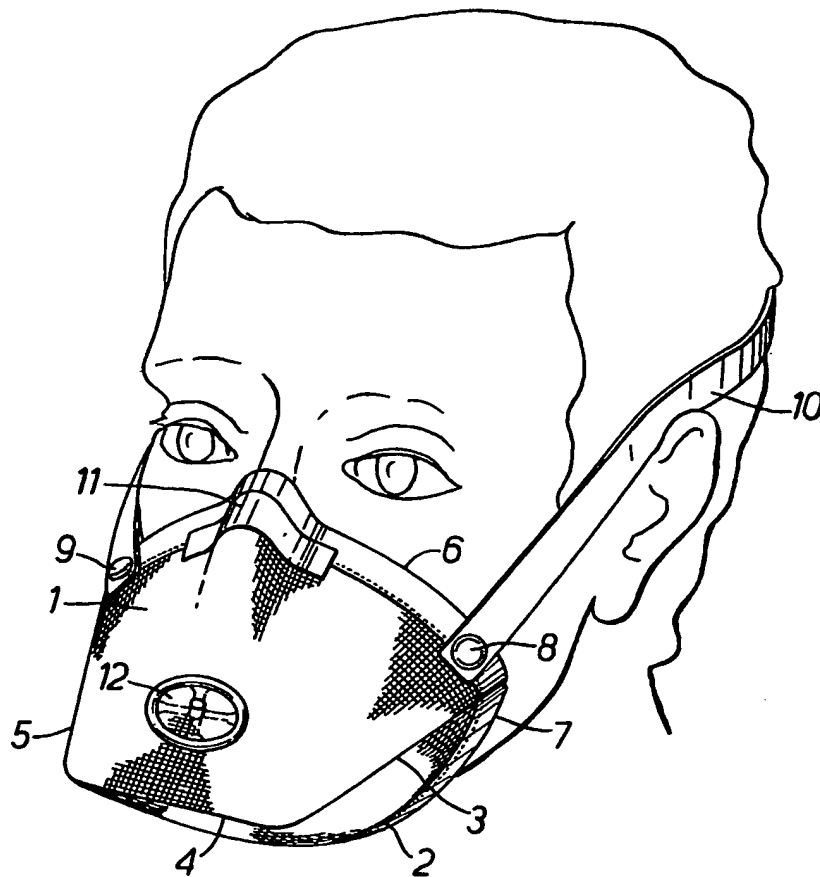


FIG. 1.

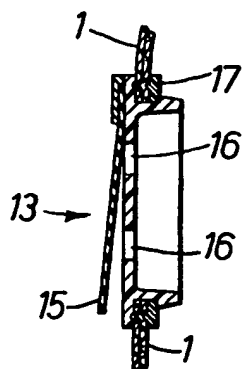


FIG. 2.

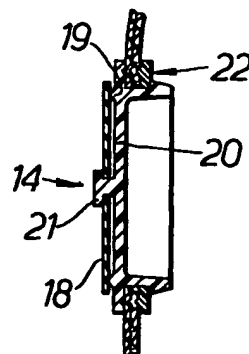


FIG. 3.

## SPECIFICATION

## Improvements in and relating to respiratory face masks

5 The present invention relates to respiratory face masks.

Respiratory face masks have been proposed previously (see the Complete Specification of  
10 British Patent Application 16079/77 in the name of the Secretary of State of Defence) which are relatively light in weight, the mask being arranged, in use, to cover the mouth and nose of the wearer and being formed  
15 from one or more sheets of filtration-effective material. Charcoal cloth, that is to say a woven or non-woven cloth primarily composed of fibrous or filamental activated carbon, is a material which has been proposed  
20 for use in such face masks, such a material being especially suitable for use in filtering out gaseous or vaporous contaminants which may be present in the surrounding atmosphere. Such a mask may also be used for  
25 filtering out particulate contaminants for example by providing it with a thin layer of appropriate filter material or the mask itself may be made of such material.

Such masks have generally been found to  
30 be satisfactory. It has now been found, however, that during relatively long periods of use or when the wearer is working particularly hard, the resistance to inhalation afforded by the mask becomes undesirably high. It has  
35 further been found that this increase in inhalation resistance results from the material of the mask becoming saturated with water vapour, predominantly exhaled water vapour.

The present invention provides a respiratory  
40 face mask in the form of a pouch shaped to cover the nose and mouth of the wearer, the pouch being formed from filtration-effective sheet material and the mask being provided with one or more exhalation valves.

45 The incorporation of the or each exhalation valve prevents or materially reduces the build-up of water vapour in the filtration-effective material of which the pouch is made during exhalation by the wearer.

50 The or each valve can be fitted in any suitable position in the pouch and may, for example, be so fitted that when the mask is worn the valve is adjacent to the nose and/or the mouth of the wearer or alternatively so  
55 that it is below the mouth, for example, in a part of the mask which is arranged to fit under the wearer's chin.

To prevent inhalation of harmful atmosphere owing to leakage of the or each valve,  
60 the valve may be provided with an antechamber so arranged that, if the valve does leak in operation, the wearer inhales previously exhaled breath and not the harmful atmosphere.

65 The or each valve may be of any suitable

form and may, for example, be a flap valve or a diaphragm valve.

Although the sheet material may be made from any material which is filtration-effective,  
70 it is of advantage if it comprises cloth which may be woven or non-woven and, preferably, an activated charcoal cloth.

A single thickness of filtration-effective sheet material may be used to form the pouch  
75 but to increase its filtration qualities and to increase its life-time two or more layers which may be laminated of filtration-effective sheet material may be used.

Further, the sheet material may comprise  
80 two outer sheets (of, for example, cloth) and between those sheets a filtration-effective layer which may also be of sheet form (for example an activated charcoal cloth) or may comprise a filler material.

85 Excluding the exhalation valve or valves, the mask may be constructed as disclosed in the Complete Specification of British Patent Application No. 16079/77 to which attention is directed.

90 A facelet mask constructed in accordance with the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

95 *Figure 1* is a perspective view of the mask in position on the face of a wearer;

*Figure 2* is a side view, in section, of one type of valve that can be incorporated in the mask shown in Fig. 1; and

100 *Figure 3* is a side view, in section, of a second form of valve which can be incorporated in the mask shown in Fig. 1.

Referring to the accompanying drawings and first of all to Fig. 1, the mask is in the  
105 form of a pouch comprising two portions 1 and 2 which are joined together along meeting edges 3, 4 and 5.

Each of the portions 1, 2, is made up, at least in part, of a filtration-effective sheet  
110 material, preferably activated charcoal cloth. Each portion 1, 2 comprises a single sheet or two or more sheets of filtration-effective material. Each sheet is trapezoidal in shape when laid flat and the sheet(s) in the portion 1 are  
115 separate from the sheet(s) in the portion 2. Each portion 1, 2 has on one or both sides a co-extensive sheet of backing material, all the sheets being joined together, for example by stitching along the meeting edges 3, 4 and 5.  
120 The backing material is provided so that the mask retains its shape better in use and so that its strength and resistance to wear is increased.

As an alternative to using sheets as described above, double-layer sheets which are trapezoidal in shape can be used, each double layer sheet being formed by folding over on itself a sheet which, when laid flat, is in the form of a regular hexagon.

130 Further, the or each trapezoidal sheet in the

portion 1 may, instead of being separate from the or a corresponding sheet in the portion 2, as described above, be formed integrally therewith, the sheets being joined along a common line 4. In that case the or each sheet is folded about the line 4 and the sheets are then joined along the edges 3 and 5.

At the face-contacting edges 6 and 7, the layers of material are folded back and stitched or otherwise joined together to prevent the material from fraying in that region. At the corners of the mask adjacent to the face-contacting edges 6 and 7 press-studs 8 and 9 serve to secure a strap 10 to the body of the mask to hold the mask on the face of the wearer. Adjacent to one face-contacting edge 6 and running for a short distance on either side of the centre point of the edge is a deformable strip of readily deformable metal, for example aluminum, which is held in place by a covering strip 11 of adhesive tape.

Alternatively, the strip of metal may be held in place, for example by stitching, between two sheets or layers of filtration-effective material. In this case, the metal strip may, before it is fitted, be covered—at least along its edges—with a foamed plastics material to prevent the strip damaging the filtration-effective material.

Provided in the portion 1 of the mask, although it could instead be provided in the portion 2, is an exhalation valve 12 (two or more such valves could be provided).

The valve 12 is a flap valve 13 as shown in Fig. 2 or a diaphragm valve 14 as shown in Fig. 3, the valve of Fig. 3 being that shown in position in the mask of Fig. 1.

The flap valve 13 of Fig. 2 comprises a flexible circular flap member 15 of, for example, plastics material, which is arranged to cover and closed valve openings 16 during inhalation and to flex away from those openings during exhalation. To allow flexing of the flap member 15 a part of its peripheral portion, a segment of the flap member, is fixed in position, the remaining part of the flap member being left free. The valve is fitted in an aperture in the mask and is held in place by a retaining ring 17 which engages the edge portion of that opening to provide an effective seal.

The diaphragm valve 14 shown in Fig. 3 comprises a flexible circular valve member 18, preferably made of rubber, which is so arranged that during inhalation it engages with a circular knife-edge valve seat 19 and during exhalation it flexes away from that seat to allow air to pass through valve openings, not shown, in a valve plate 20. To allow flexing of the valve member 18 it is mounted on the valve plate by a hub 21, the remaining part of the valve member being left free. As in the case of the valve shown in Fig. 2, the valve shown in Fig. 3 is mounted in an opening form in the mask and is secured to the mask by a retaining ring 22.

The mask described and illustrated above is especially suitable for filtering out gaseous or vaporous contaminants but the filtration-effective material may be such that the mask can be used to filter out particulate contaminants. For example, the filtration-effective material may include a layer of appropriate filter material or it may be constituted by such a material.

## CLAIMS

1. A respiratory face mask in the form of a pouch shaped to cover the nose and mouth of the wearer, the pouch being formed from filtration-effective sheet material and being provided with one or more exhalation valves.

2. A face mask as claimed in claim 1, in which the or each valve is so fitted in the mask that when the mask is worn the valve is adjacent to the nose and/or the mouth of the wearer.

3. A face mask as claimed in claim 1, in which the or each valve is so fitted in the mask that when the mask is worn the valve is below the mouth of the wearer.

4. A face mask as claimed in claim 1 or claim 3, in which the or each valve is in a part of the mask which is arranged to fit under the chin of the wearer.

5. A face mask as claimed in any one of claims 1 to 4, in which the or each valve is provided with an antechamber so arranged that, if the valve leaks in operation, the wearer inhales previously exhaled breath and not harmful atmosphere.

6. A face mask as claimed in any one of claims 1 to 5, in which the or each valve is a flap valve.

7. A face mask as claimed in any one of claims 1 to 5, in which the or each valve is a diaphragm valve.

8. A face mask as claimed in any one of claims 1 to 7, in which the sheet material is cloth which may be woven or non-woven.

9. A face mask as claimed in any one of claims 1 to 8, in which the sheet material is an activated charcoal cloth.

10. A face mask as claimed in any one of claims 1 to 9, in which a single thickness of filtration-effective sheet material is used to form the pouch.

11. A face mask as claimed in any one of claims 1 to 9, in which two or more layers of filtration-effective sheet material are used to form the pouch.

12. A face mask as claimed in claim 11, in which the layers are laminated.

13. A face mask as claimed in any one of claims 1 to 9, in which the sheet material comprises two outer sheets and between those sheets a filtration-effective layer.

14. A face mask as claimed in claim 13, in which the two outer sheets are cloth.

15. A face mask as claimed in claim 13 or claim 14, in which the filtration-effective layer

is of sheet form.

16. A face mask as claimed in claim 13 or claim 14, in which the filtration-effective layer comprises a filler material.

5 17. A face mask as claimed in any one of claims 1 to 16, in which the pouch is constituted by two portions which are joined together along corresponding meeting edges, each portion being trapezoidal in shape when  
10 laid flat.

18. A face mask as claimed in claim 17, in which each portion is formed separately.

19. A face mask as claimed in claim 17, in which the two portions are formed from a  
15 single member which is folded to form one edge of the pouch, the other edges being subsequently joined together.

20. A face mask as claimed in any one of claims 17 to 19, in which each portion comprises a single sheet or two or more layered  
20 sheets of filtration-effective material.

21. A face mask as claimed in claim 20, in which the or each sheet is a double-layer sheet, each double layer sheet being formed  
25 by folding over on itself a sheet which when laid flat, is in the form of a regular hexagon.

22. A face mask as claimed in any one of claims 17 to 21, in which the, or at least one of the valves is provided in one of the said  
30 portions.

23. A face mask as claimed in any one of claims 1 to 22, in which the or each valve is sealingly secured in an aperture in the mask.

24. A respiratory face mask substantially  
35 as herein before described with reference to, and as shown in the accompanying drawing.

25. A respiratory face mask as claimed in any one of claims 1 to 23, the valve being substantially as hereinbefore described with  
40 reference to and as shown in Fig. 2 or Fig. 3.